Nuclear Development

Accelerator-driven Systems (ADS) and Fast Reactors (FR) in Advanced Nuclear Fuel Cycles

A Comparative Study

NUCLEAR ENERGY AGENCY
ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

FOREWORD

Partitioning and transmutation (P&T) aims at reducing the amount of actinides, and thus the radiotoxicity of the high-level waste (HLW) going to disposal. Its purpose is ultimately to facilitate the geological disposal of actinide-containing HLW. To make this technologically complex process worthwhile, a reduction of the long-term radiotoxicity of HLW by a factor of at least one hundred is desirable.

The first OECD/NEA system study, entitled "Status and Assessment Report of Actinide and Fission Product Partitioning and Transmutation" (1999), already studied the necessary technologies to achieve this goal. However, the more effective transmutation strategies with fully closed fuel cycles and the specific role of accelerator-driven systems (ADS) in these fuel cycles were the not addressed. The present, second P&T systems study closes this gap and compares fast reactor (FR) and ADS-based actinide transmutation strategies in order to highlight the specific role that ADS might play and the main differences between ADS and FR with respect tot reactor properties, fuel cycle requirements, economic aspects, and R&D needs.

P&T is introduced in the first two chapters. The comparative analysis using a consistent set of transmutation strategies is addressed in Chapter 3. The status of FR and ADS technologies is compared in Chapter 4; Chapter 5 analyses the safety aspects of both systems. The report addresses the economics of transmutation strategies in Chapter 6, the perceived R&D needs in Chapter 7 and fission product transmutation and alternative approaches to the selected strategies in this study are described in Chapters 8 and 9 respectively. Each technical chapter carries its own conclusions. The overall conclusions of this study are given in Chapter 10.

The present report has been prepared by the group of experts listed in Annex A and is published under the responsibility of the Secretary General of the OECD. It does not necessarily represent the official governmental opinion nor that of the international organisations involved.

Acknowledgements

The Expert Group wants to thank Mr. Marco Cometto for his valuable help in conducting the neutronic analyses of the fuel cycle schemes. The group is also grateful to Dr. Sigg, Dr. Stammbach, Dr. Pagani and Dr. Lawrence for their input on accelerator technology and thank also Dr. Craig Hogget-Jones for his input on waste production data. Thanks goes also to Dr. Knebel for his input on spallation target technology.

The group wishes to dedicate this report to the family of our colleague and friend, Dr. Mikael Björnberg, who passed away during the period of this study and who would surely have been a supporter of its outcome.